Climate variation and anthropometric indicators of under-5 nutrition: Bangladesh, 1990-2006

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BACKGROUND & PURPOSE

Existing research identifies several pathways by which climate variability influences nutrition: food and financial insecurity, gender-based disempowerment, health services availability, and environment.[1] These pathways exhibit multiple timescales through long-term, seasonal, and interannual climate variation, and short-term extreme events.[2]

However, research seldom differentiates nutritional vulnerabilities resulting from climate variation at multiple timescales, e.g. seasonal patterns versus short-term extreme events. This study considers such climate-nutrition associations among children in Bangladesh.[3,4]

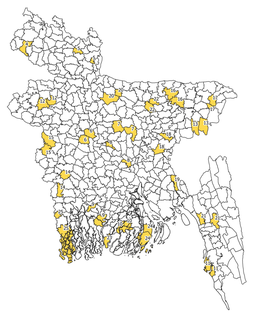
HYPOTHESIS

We hypothesized that climate patterns are associated with childhood wasting (weight-for-height Z-score [WHZ] < -2) at multiple timescales, specifically at seasonal and shorter (here, monthly) scales.

METHODS

Daily precipitation and minimum/maximum temperature were observed from 1990 to 2006 for 22 subdistricts (or pairs of subdistricts) in Bangladesh. Nutritional status of children under 5, measured by calculating weight-for-height Z-scores (WHZ), was matched by child to climate exposure by date and subdistrict.

Subdistricts of Bangladesh Surveyed, 1990-2006



Subdistricts Surveyed

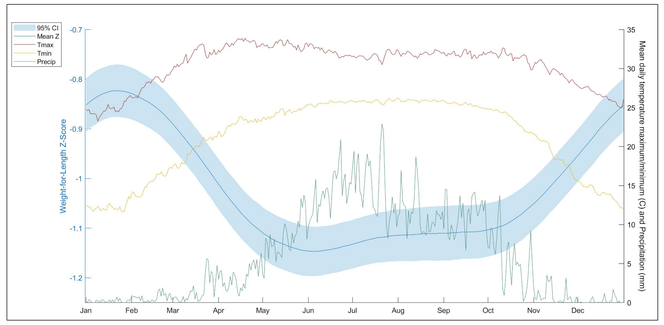
1 Dhaka area	14 Jhikargachha/Kaliganj
2 Khulna area	15 Daulatpur/Gangni
3 Chittagong area	16 Derai/Jamalganj
4 Pirganj	17 Golapganj/Fenchuganj
5 Chilmari/Kaunia	18 Sarail/Nabinagar
6 Santhia/Shahjadpur	19 Chouddagram
7 Shakhipur/Sreepur	20 Nakla/Jamalpur Sadar
8 Saturia/Serajdikhan	21 Rangunia/Hathazari
9 Morrelganj/Fakirhat	22 Kendua/Atpara
10 Mirzaganj/Patuakhali sadar	23 Pathargantha
11 Moheshkhali/Cox's Bazaar	24 Charfassion/Lalmhan
12 Manda/Naogaon Sadar	25 Shyamnagar/Debhata
13 Kamalganj/Sreemangal	

Average seasonal cycles for climate and nutrition were modeled by subdistrict using Fourier smoothing techniques. Log-binomial regression models were used to estimate short-term crude associations between extreme climate events (ECEs) and nutritional status.

RESULTS

Considering all subdistricts surveyed from 1990 to 2006, we observed crude climate-nutrition correlations after plotting average seasonal cycles of child wasting (**blue**), maximum (**red**) and minimum (**yellow**) temperature, and precipitation (**green**).

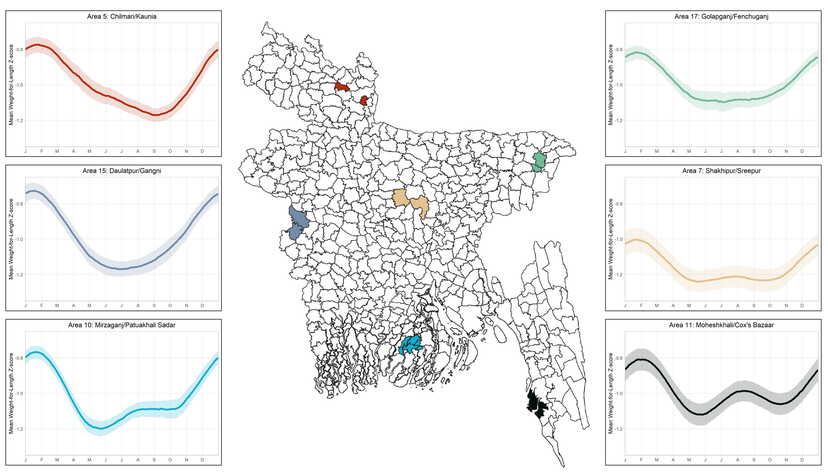
Climate vs. Nutrition Seasonality
Multiyear average plots, 1990-2006



Wasting (WHZ < -2) prevalence across all children surveyed from 1990 to 2006 (N = 782364) was **14.94%**.

Mean WHZ (and thus wasting prevalence) varied when disaggregated by time of year and subdistrict, suggesting seasonal and geographic modification of a climate-nutrition relationship. We used Fourier harmonics (pairs of sine-cosine curves) to model the average seasonal cycle of childhood wasting for a typical year in each area. The figure below displays six of the 22 subdistricts' seasonal wasting (WHZ) curves.

Seasonal Patterns in Under-5 Nutrition
Example multiyear average plots disaggregated by subdistrict, 1990-2006

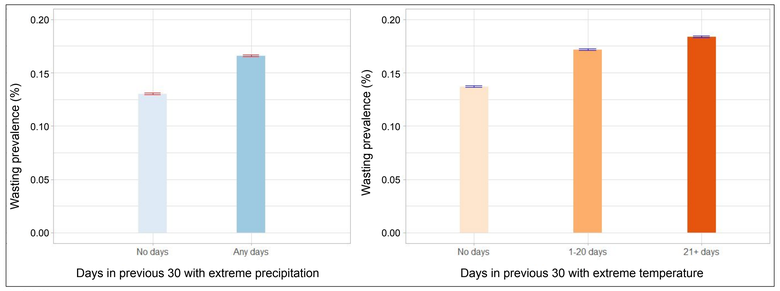


We defined extreme climate events (ECEs) as days exceeding the 95th percentile for subdisctrict-specific precipitation or maximum temperature from 1990 to 2006. We counted the number of ECEs experienced by each individual (N = 642922) during the past 30 days.

In separate log-binomial regression models, ECEs in the past 30 days were associated with higher wasting prevalence in children under 5.

Under-5 Wasting Prevalence
by extreme climate events in past 30 days

Extreme Climate Event	Prevalence Ratio (95% CI) *Reference: No days in past 30*	Case Group Prevalence (95% CI)	Reference Group Prevalence (95% CI)
Extreme precipitation			
1+ days in past 30	1.27 (1.26, 1.29)	16.60% (16.51, 16.69)	13.03% (12.95, 13.11)
Extreme heat			
1-20 days in past 30	1.25 (1.24, 1.27)	17.17% (17.08, 17.26)	13.71% (13.63, 13.79)
21+ days in past 30	1.34 (1.25, 1.44)	18.39% (18.30, 18.48)	13.71% (13.63, 13.79)



N = 642,922
Note: Error bars represent 95% confidence intervals for proportions

CONCLUSIONS

Childhood nutrition is highly seasonal and depends on location. This presents opportunities for regional and seasonal nutrition intervention.

Further, these preliminary models suggest that climate may influence child nutrition at multiple timescales. Further analyses will assess causality and mediating factors.

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